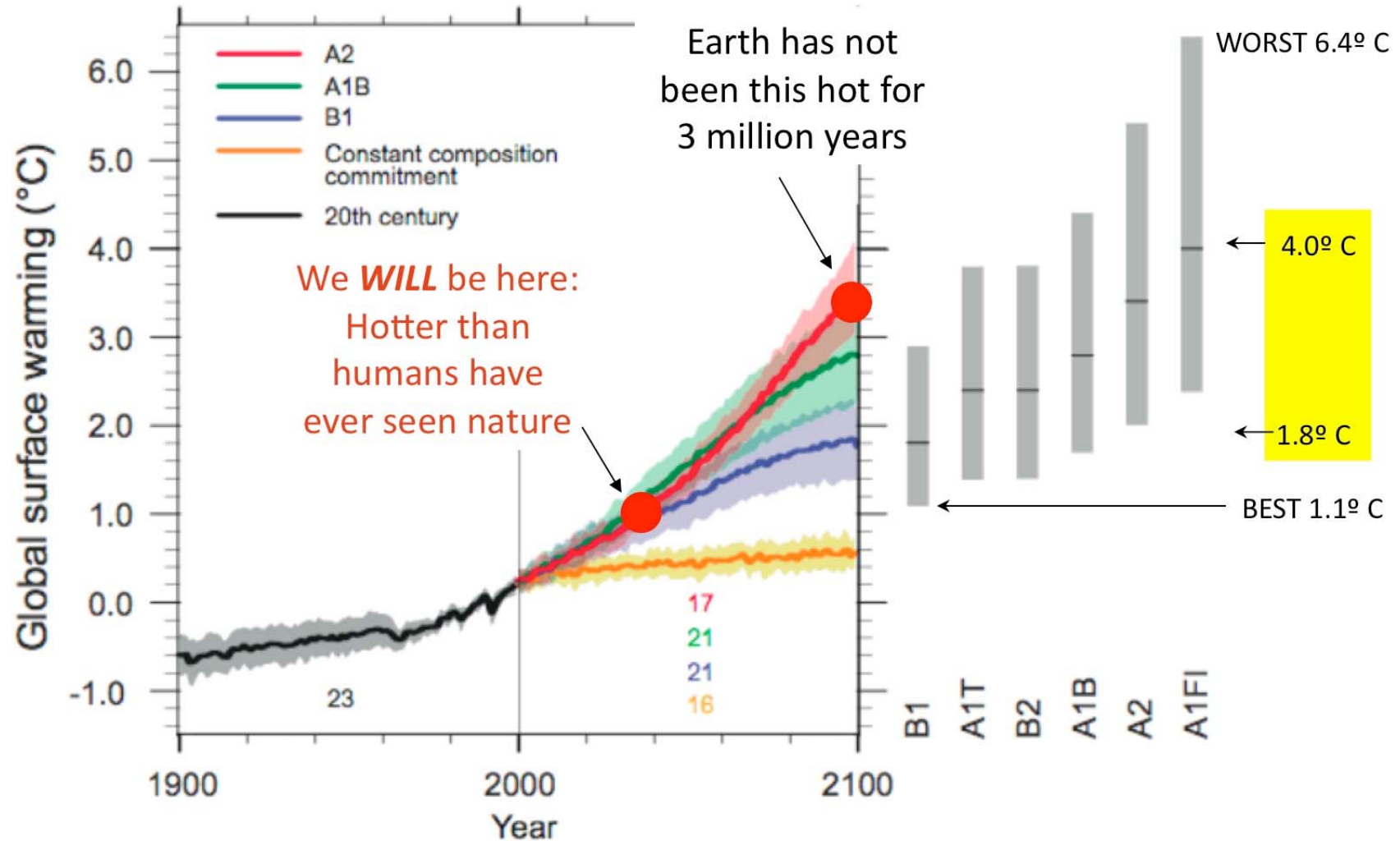


Nature in an Age of
Global Warming

Heatstroke

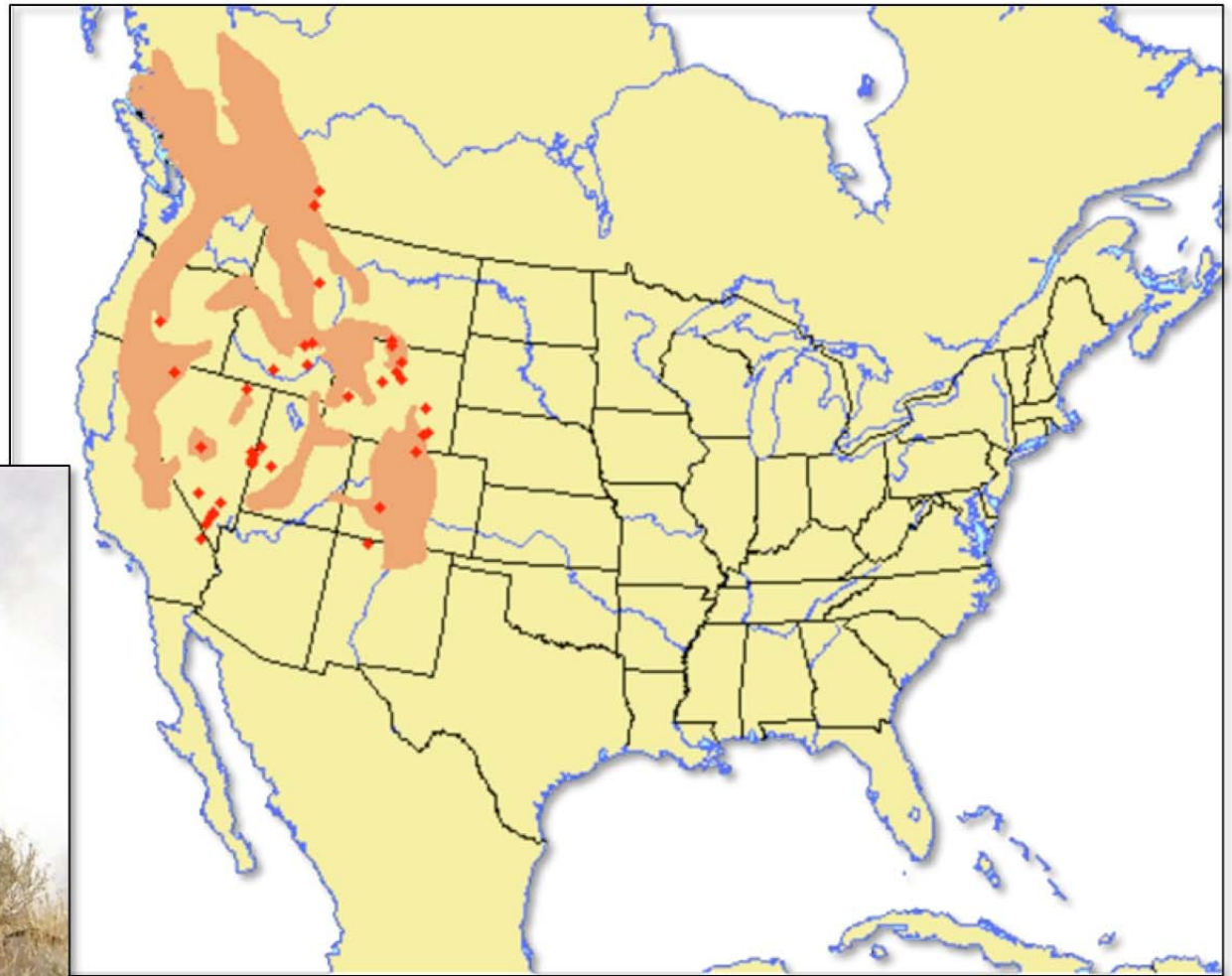
ANTHONY D.
BARNOSKY

Even the best case means nature is in for some big changes



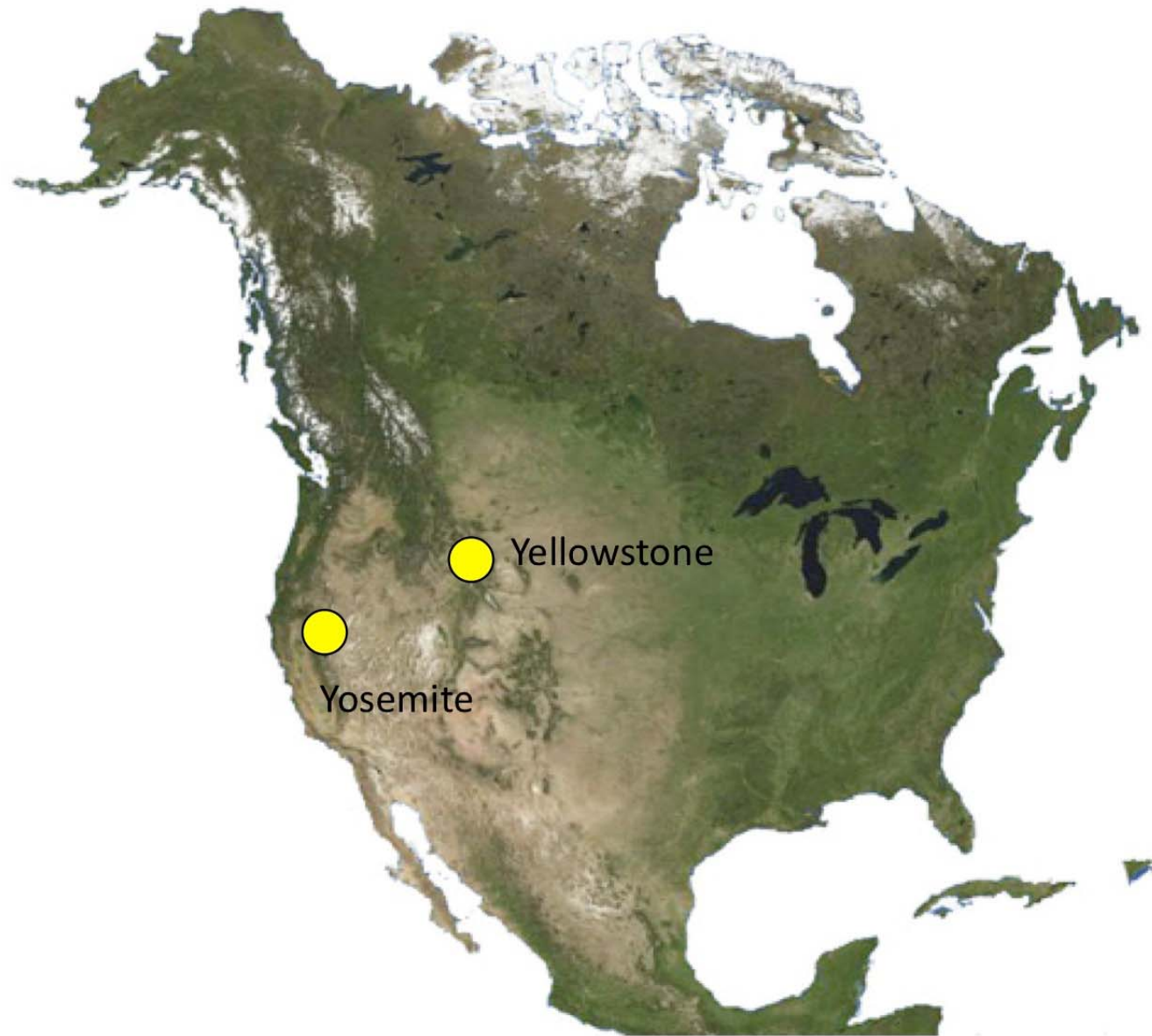
Mammal Biodiversity

Disappearing from hot mountaintops



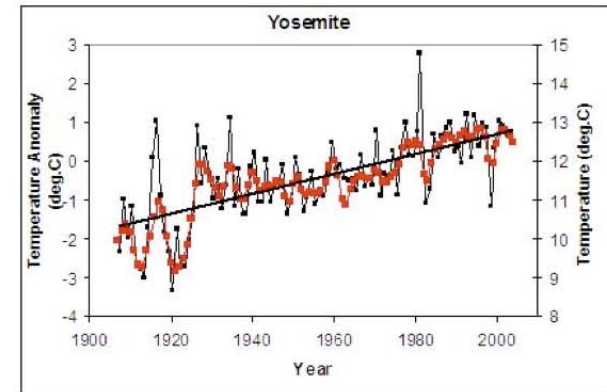
<http://www.daylife.com/photo/0gYUgHE4RrdCR>

Yellowstone National Park



100 years in Yosemite

UC Museum of Vertebrate Zoology
Grinnell Resurvey Project



<http://tamino.files.wordpress.com/2006/12/yosemite.JPG>



Joseph Grinnell, 1922



Jim Patton, ca. 2004

~ 50% of small-mammal species affected by warming temperatures

3000 years in Yellowstone



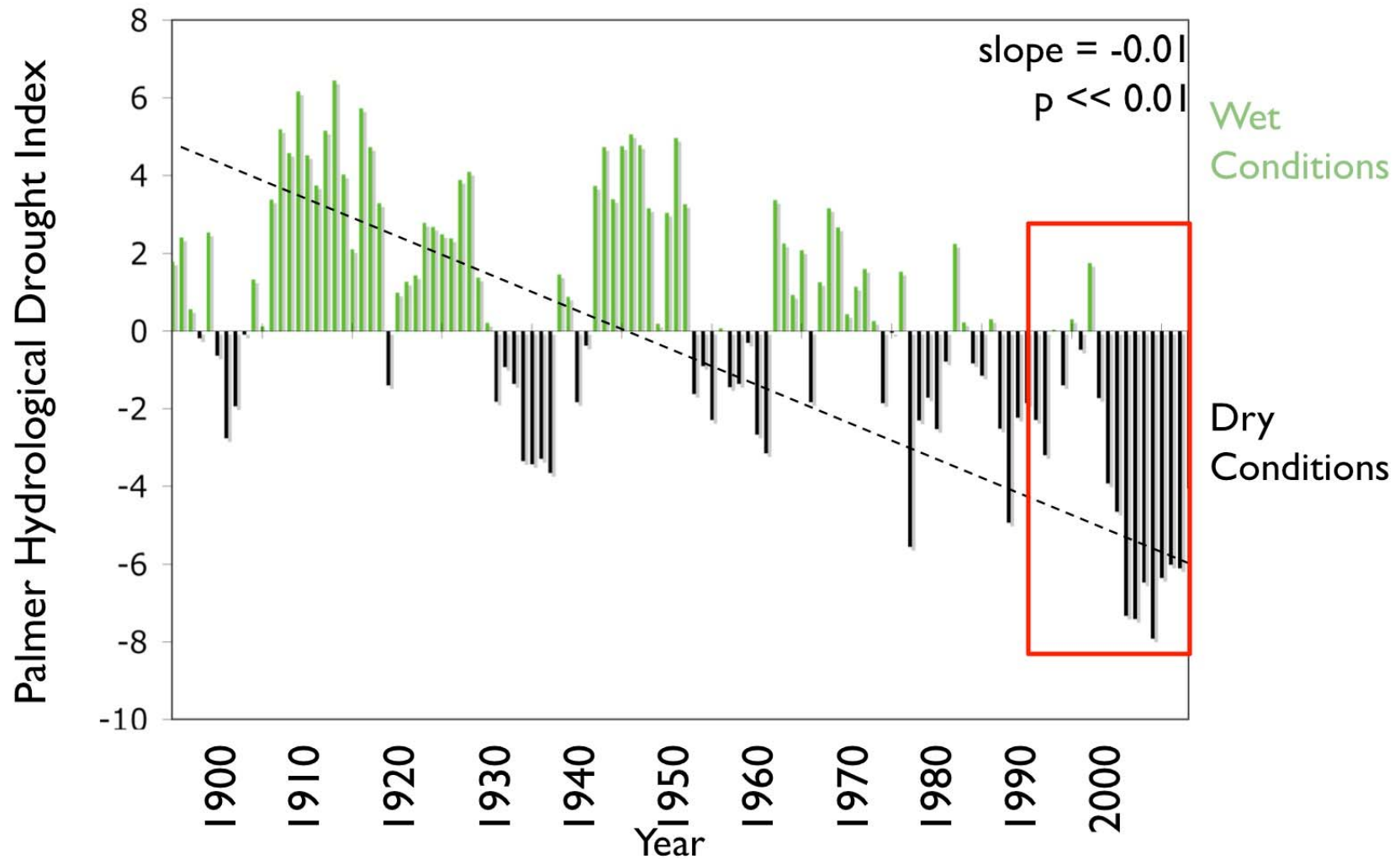
All native mammal
species in the park
persisted throughout

Only 1 scarce vole
species missing today



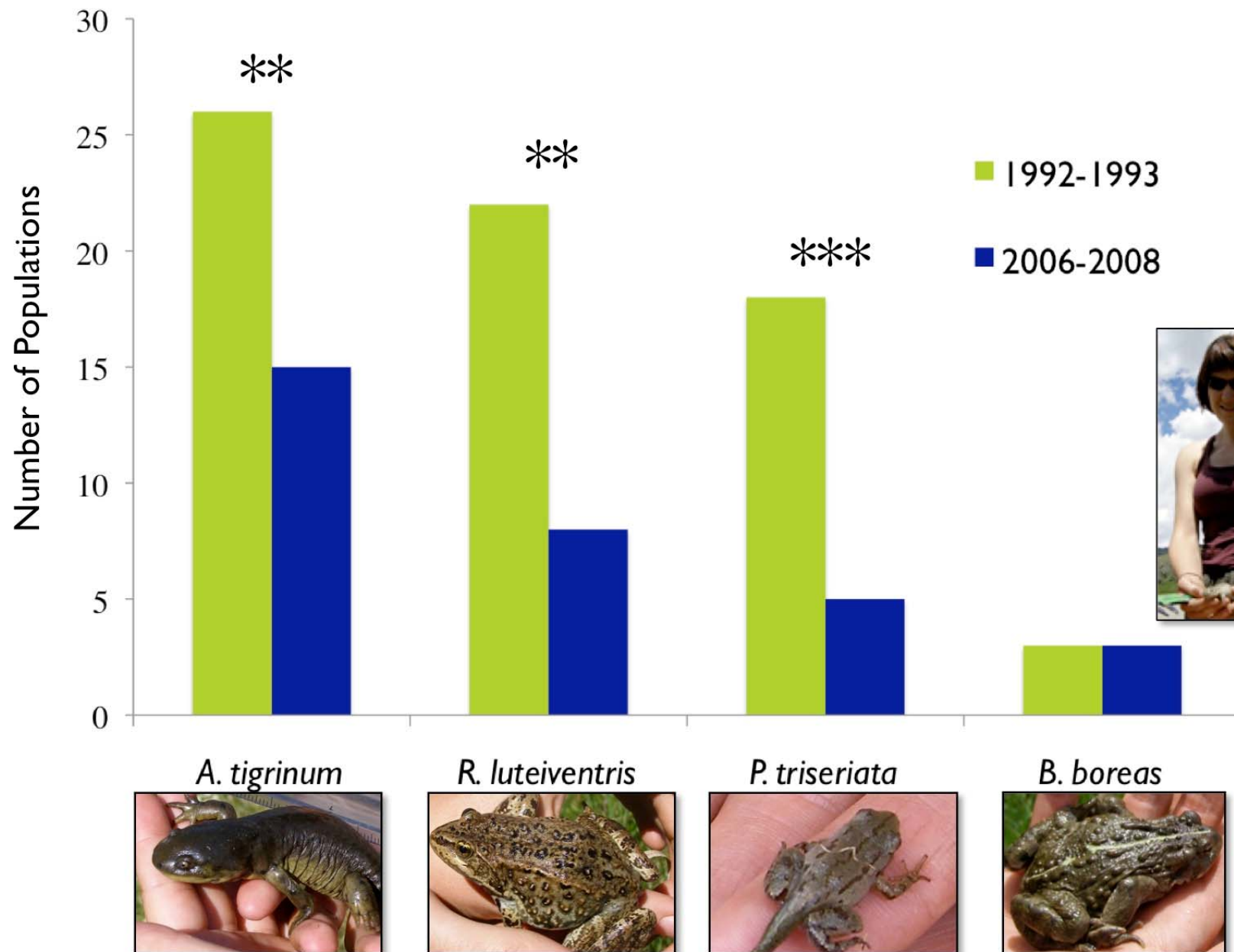
Liz Hadly

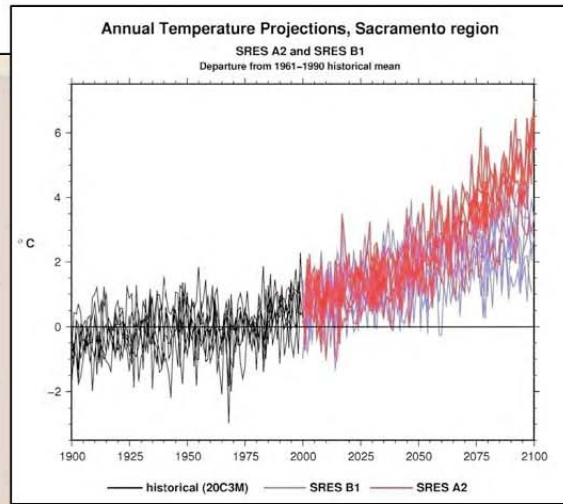
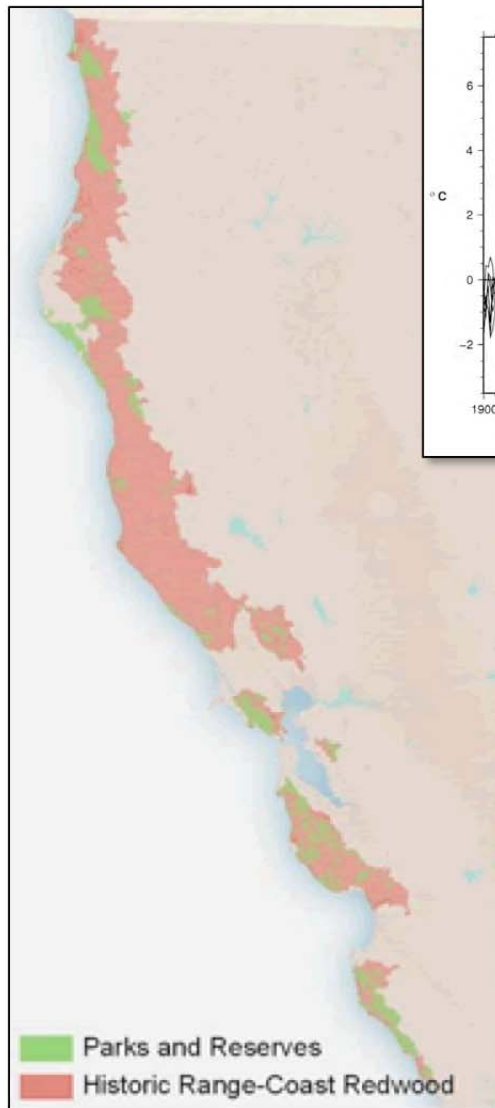
Drought in Yellowstone



Data From: USGS (2008) *USGS Real-Time Water Data for Montana*

Amphibian Population Declines





Plants in CA

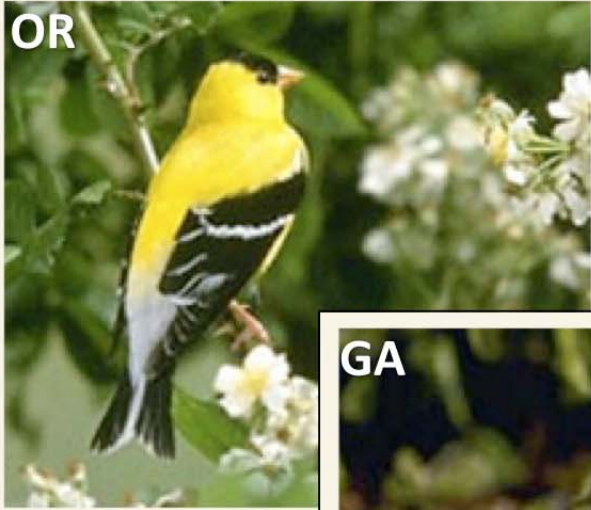
2/3 of the 2387 species
found only in California will
lose 80% of where they
can now live



<http://www.climatechange.ca.gov/publications/cat/index.html>

<http://www.guardianweekly.co.uk/?page=editorial&id=473&catID=4>

OR



GA



CA



Birds

Some states in danger
of losing their state
birds

New seasonal patterns



<http://www.foxnews.com/story/0,2933,446686,00.html>



<http://www.wise4living.com/sfish/images/fall-fly-fishing-idaho.jpg>



Fisheries

Warmer waters

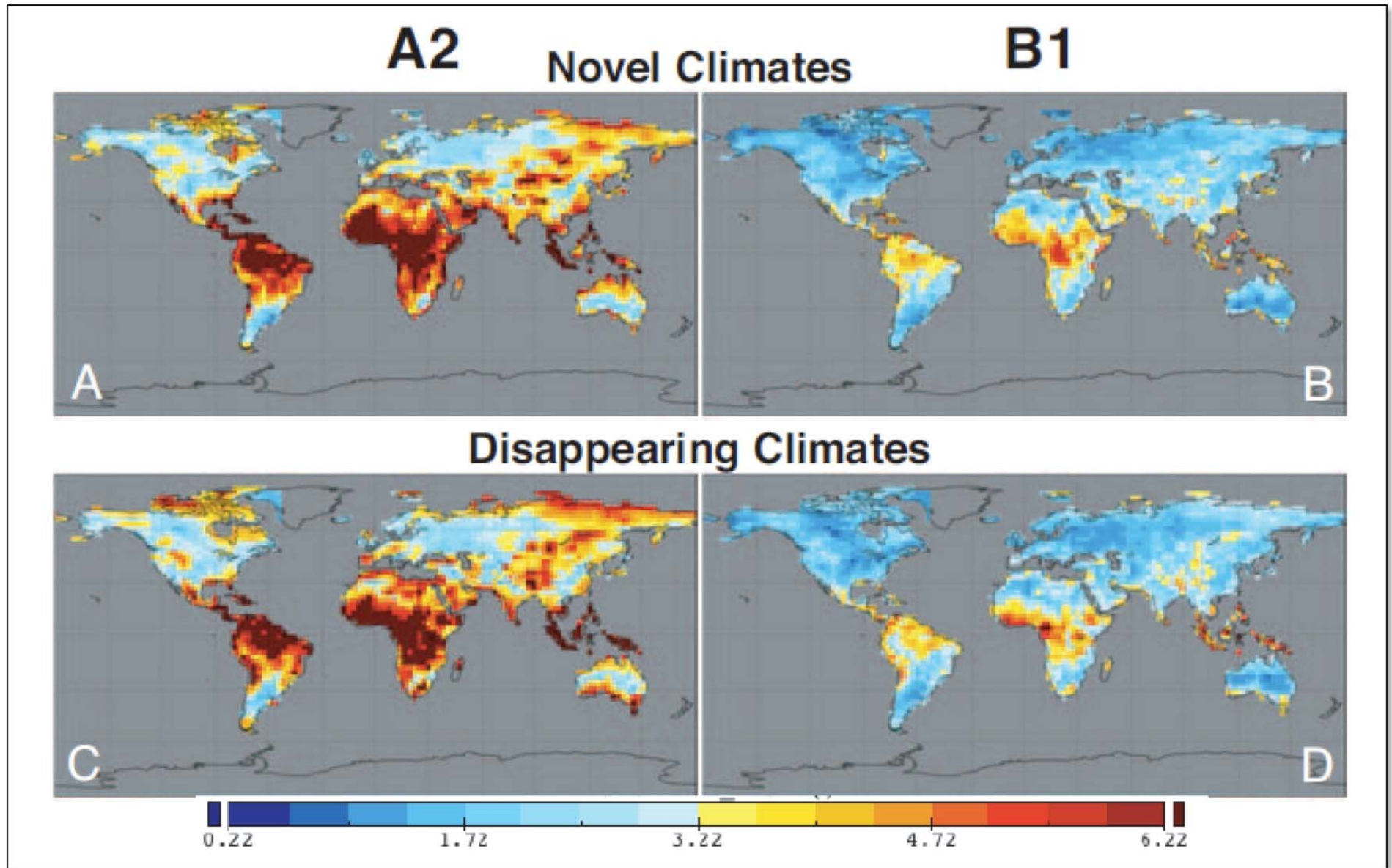
Trout & Salmon Habitat
reduced 18-38% of
current range

Economic Impacts



<http://www.nrdc.org/globalWarming/ntrout.asp>

Worldwide Conservation Problem



Mammal Species Turnover in African Parks Due to Warming

Park in 2050	Species in 2006	Species Lost	Species Gained	Faunal Turnover
Kruger	87	10 to 11	16 to 18	5 to 8 (.06 to .09%)
Kalahari	45	23 to 25	6 to 7	-16 to -19 (-35 to 42%)



Park in 2080	Species in 2006	Species Lost	Species Gained	Faunal Turnover
Kruger	87	13 to 20	19 to 20	0 to +6
Kalahari	45	39	8 to 10	-29 to -31 (-64 to 69%)

Critically Endangered Mammals in Africa Due to Warming

	2050	2080
Free Dispersal		10 to 20%
No Dispersal	10 to 15% of species	25 to 40%



*New Needs for Nature:
Ecosystem Services
Species (Biodiversity)
Feeling of Wilderness
46% of Earth's lands
12%-Nature reserves*



The Treatments

1. Slow the global warming train



New Management

Keep

Connect

Create (Conceptually & Physically)



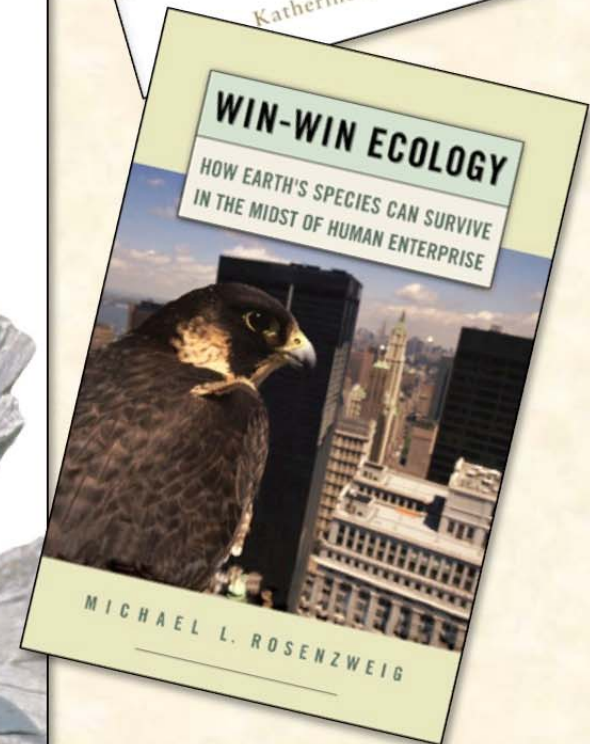
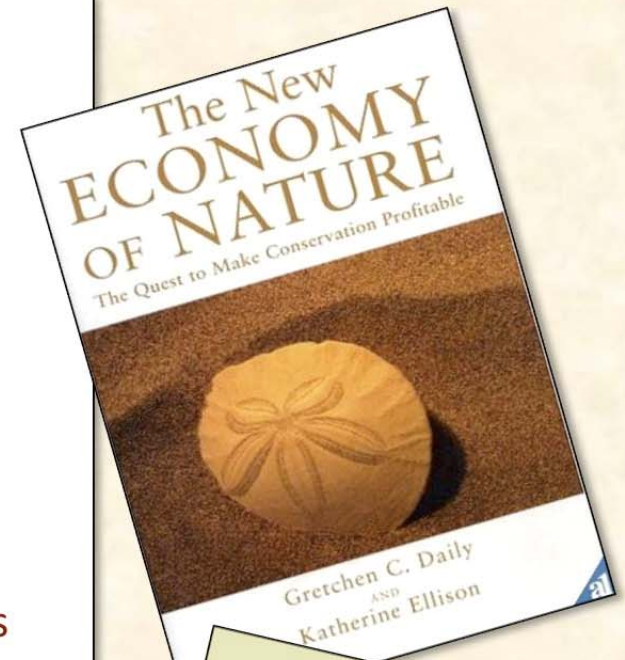
Keep

The nature preserves
we have

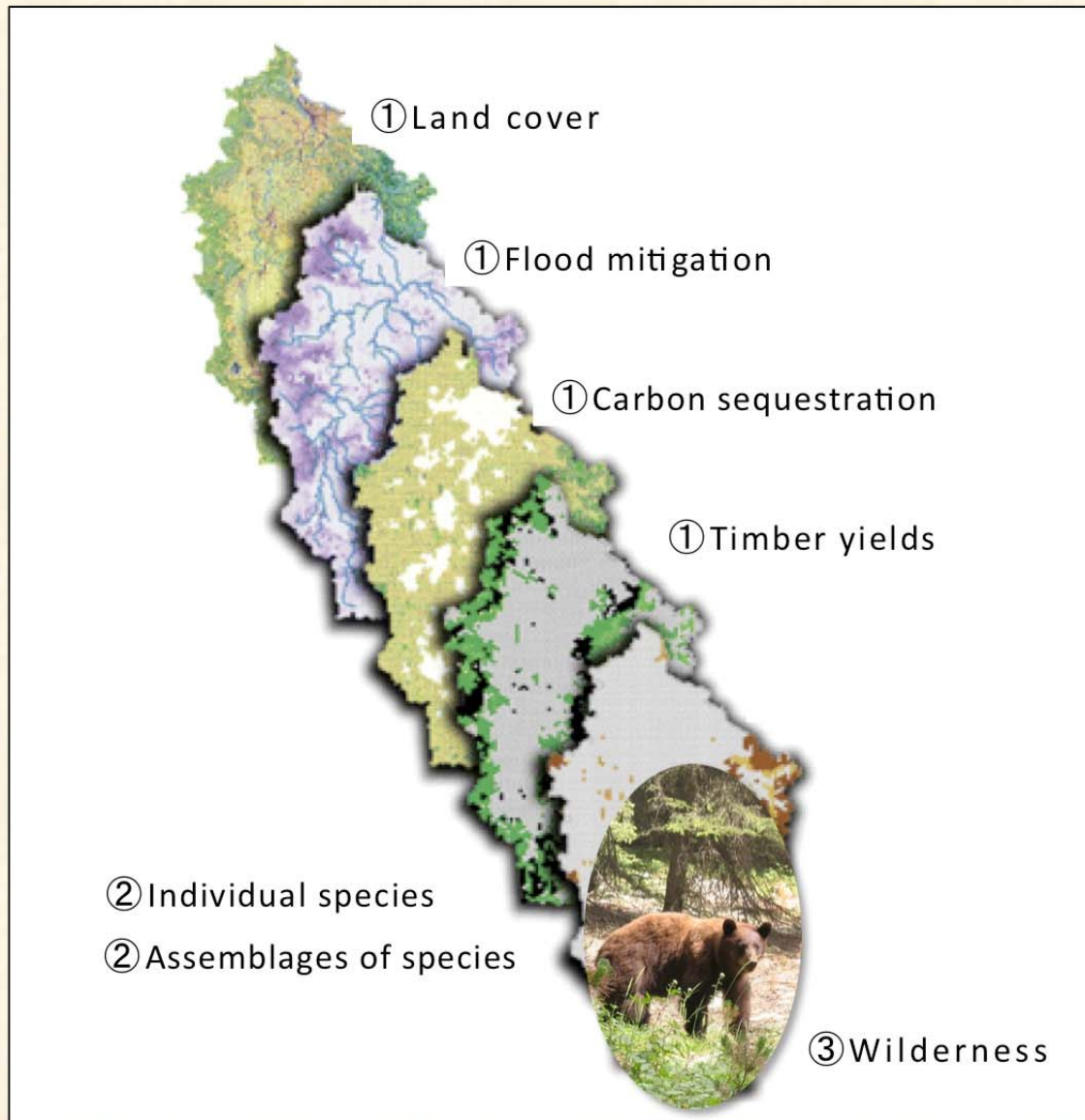
Species alive however
we can

Connect

With climate corridors
where we can



Create (conceptually)



Explicit recognition
that we need to save
different things

① Ecosystem
services

② Biodiversity

③ Feeling of
Wilderness

One-stop shopping no longer will work

Can exist without full
biodiversity or wilderness



But not without
careful
management

*Feeling of
Wilderness*

Individual species
extinctions inevitable without heavy management

Certain assemblages of species
Can no longer persist without heavy management

Cannot persist with heavy
management

Create (physically)

Separate-but-equal kinds of nature preserves

Marbled Whites + 65 km



Bay Checkerspot



'Species Preserves'

Sustain individual species
or assemblages of species
in danger of extinction

Assisted migration?

Pleistocene Re-wilding?

Zoos?

<http://e360.yale.edu/content/feature.msp?id=2142>

http://www.sfgate.com/cgi-bin/blogs/chrongreen/detail?blogid=50&entry_id=28645

Create (physically)

Separate-but-equal kinds of nature preserves



‘Wildland Preserves’

Sustain ecological
dynamics that are not
dominated by humans

Species will disappear and
rearrange

Feeling of wilderness
remains



Potential Species Reserves

Places with open space, but not entirely pristine



Pryor Mountains, Montana

Forest Service

BLM

Some State Parks

Sustain individual
species or assemblages
of species in danger of
extinction

Assisted migration?
Pleistocene Re-wilding?
Zoos?

Potential Wildland Reserves

Places less impacted by people



Yellowstone National Park

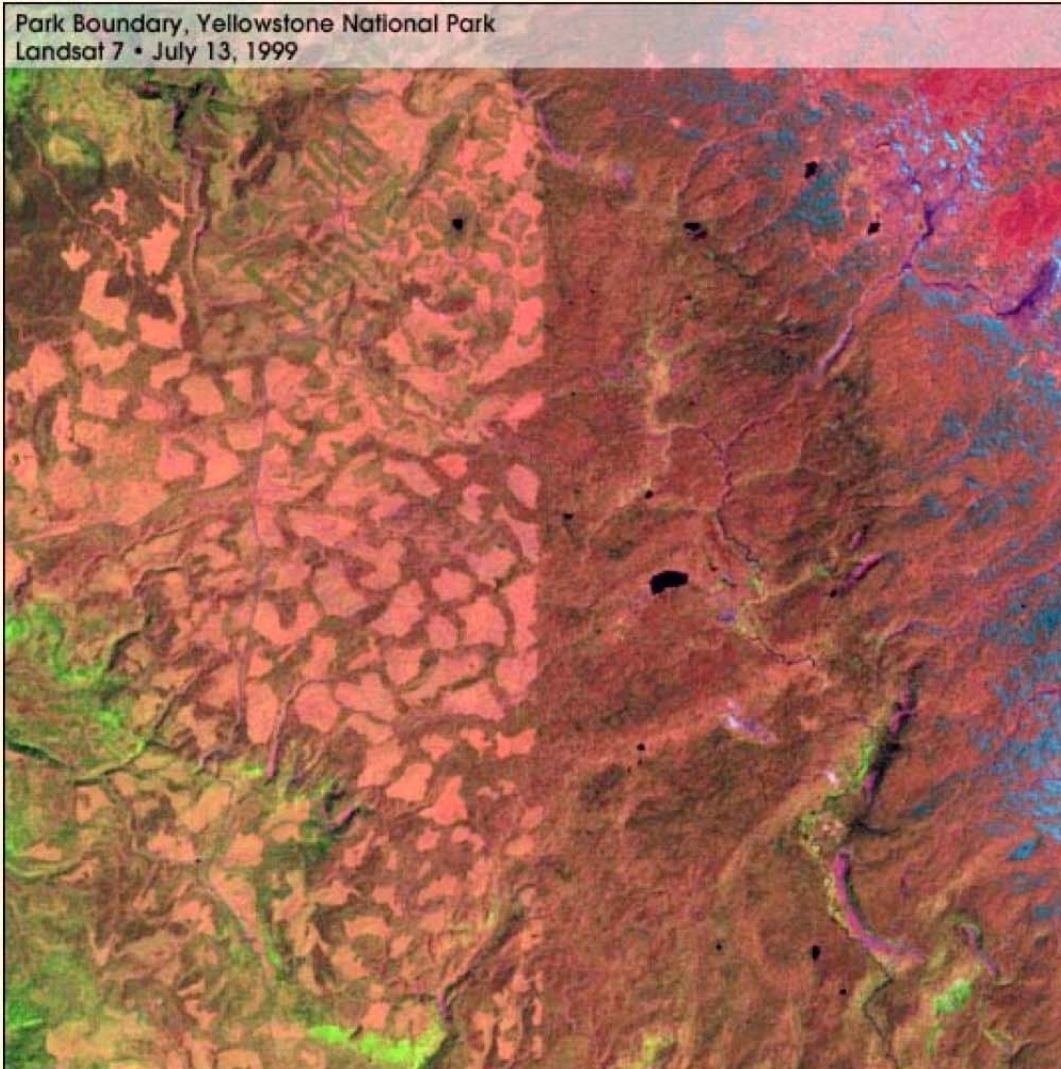
*Some National Parks
Wilderness Areas
Remote Places*

Sustain ecological
dynamics that are not
dominated by humans

Species will disappear
and rearrange

Feeling of wilderness
remains

The Road Map



Recognize the problem

Scientists and policy
makers that think
outside the box

Interstate and
International
cooperation

Legislation and re-
vamping the world
nature reserve system

Nature in an Age of Global Warming

Heatstroke

ACT NOW. OR ELSE.

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